ATTACHMENTS

Department of Air Quality Management

651 Shadow Lane • Las Vegas NV • 89106
(702) 383-1276 • Fax (702) 383-1443

APPLICATION FOR AN AUTHORITY TO CONSTRUCT CERTIFICATE

Facility ID# A 114 **(if modification)** **Date:** Revised 12/02/03

I. **Applicant's name address and phone number: (*Please Print or Type*)**

Name: Simplot Silica Products

Address: 665 Simplot Road

City: Overton State: NV Zip: 89040

Phone Number: (702) 397-2667 FAX:(702) 397-2798

Land Owner: J.R Simplot **Phone:** ()

II. **Company name, address and phone number, if different from the applicant: (*Please Print or Type*)**

Name: J. R. Simplot Company

Address: P. O. Box 27

City: Boise State: Idaho Zip: 83707-0027

Phone Number:(208) 389-7365 FAX:( )

III. **Facility name and address: (*Please Print or Type*)**

Name: Simplot Silica Products

Address: 665 Simplot Road

City: Overton State: NV Zip: 89040

Phone Number: (702) 397-2667 FAX:(702) 397-2798

Plant Manager: Mr. Tom Bender **Phone:** (702) 397-2667

Fax: (702) 397-2798 **Mobile:**(702)

<u>Do not send us any documents larger than 11x 17" with your application.</u>

IV. **Person responsible for <u>Air Quality Control</u> matters:**

Name: Mr. Tom Bender **Phone Number:** (702) 397-2667

Person responsible for <u>Signing of Documents:</u>

Name/Title: Mr. Tom Bender **Phone Number:**(702) 397-2667

Person responsible for <u>Billing</u> matters:

Name: Mr. Tom Bender **Phone Number:** (702) 397-2667

<u>Billing Address</u>, if different from the Company: (*Please Print)*

Address: **P. O. Box 308**

City: **Overton** **State:** **NV** **Zip:** **89040**

Phone Number:(702)397-2667 **FAX:(702) 397-2798**

V. **To comply with the pre-construction application requirements of Section 12 of the Department of Air Quality Management Regulations, the applicant shall submit the following information:**

(a) **Stationary Source location map showing the property boundary with a legal description of the proposed site location: (*Please attach*)**
Please see Attachment 1.

(b) **Stationary Source site map identifying all buildings or structures on the site: (*Please attach*)**
Please see Attachment 2.

(c) **A general flow diagram identifying all processes located at the Stationary Source: (*Please attach*)**
Please see Attachment 3.

(d) **A complete detailed flow diagram of each process at the Stationary Source listing all Emissions Units associated with the process: (*Please attach)***
Please see Attachment 4.

(e) **Location of nearest residence and distance from the proposed Stationary Source: (*Please attach)***
The closest residence is the on-site housing provided by JR Simplot. The housing is approximately ½ mile from the dryer.

(f) **Zoning approved by local municipality, or a copy of a currently approved zoning map: *(Please attach)***
Not applicable – Existing Source

(g) **Copy of application for Use Permit, or decision of the zoning authority: *(Please attach)***
Not Applicable – Existing Source

(h) **Any new PM_{10} or CO Major Stationary Source proposing to locate in the non-attainment area, or any existing PM_{10} or CO Major Stationary Source located in the non-attainment area that proposes a Major PM_{10} or Major CO Modification, shall perform an analysis of alternative sites, sizes, production processes, fuel burned, and emission control techniques that demonstrate that the benefits of the proposed source significantly outweigh the environmental and social costs imposed as a result of its location, construction, or Modification. The required analysis shall be based on EPA guidance or applicable regulations: *(Please attach)***
Not applicable since the source is located in a Prevention of Significant Deterioration (PSD) area.

(i) **Identification of all Regulated Air Pollutants emitted from each Emissions Unit: *(Please attach)***
Regulated Air Pollutants are Nitrogen Oxides (NOx), Sulfur Dioxide (SO2), Carbon Monoxide (CO), Particulate Matter less 10 micron (PM10), and Volatile Organic Compounds (VOC).

(j) **Brief general description of the new Stationary Source or Modification: *(Please attach)***
The proposed modification to the drying process at the Simplot Silica facility in Overton involves replacing air pollution control equipment associated with the coal-fired sand dryer. Simplot proposes to replace the existing baghouse to limit filterable particulate matter to 0.025 grains/DSCF and to limit condensable particulate matter to an agreeable limit with DAQM based on source testing. Simplot also proposes to install a scrubber that will limit SOx emissions to 7.34 pounds per hour while burning low sulfur coal (containing less than 0.8%). The scrubber will maintain a minimum 85% control efficiency of SOx during the burning coal containing 0.6% sulfur. The control efficiency will increase while burning coal with a higher sulfur content of 0.6% but less than 0.8% so that the 7.34 SOx pound per hour limit will be maintained Simultaneous with the installation of the new baghouse and scrubber Simplot will be executing several previously postponed repair and maintenance project on the dryer system.

This modification also includes the extension of the conveyor system at the mining operation and the addition of a screen to the conveyor system. The mining pit has expanded to the south of the slurry and mill water lines over the years. In order to avoid hauling mined material, the conveyor belt has been extended to the south. A grizzly was added at the end of the conveyor extension so that large material could be removed at that initial loading point. The mining equipment could then be used to remove large material as it builds up at the beginning of the conveyor extension. The conveyor extension is shown in Attachment 7.

This modification also corrects the emission factor that was used for the NOx emissions from the dryer. The corrected emission factor has been scaled up to the maximum operating capacity of a 24-hour rolling average of 2.04 tons of coal per hour. The previous application/permit did not take into account that the performance test was performed at a coal feed rate of 1.46 tons/hr. The change in emission factors does not represent a Net Emission Increase since it is only a correction of the emission factor and not a modification to the unit or production capacity.

An additional process consisting of a conveyor, screen and hopper have been added to the facility to capture the screen oversize. The process will be located next to the feed coming out of the dryer. The hopper will be located next to the existing oversize piles that are fed from the screen/conveyor immediately after the dryer. The material will be loaded into a hopper that feeds into a screen and the screened material will be conveyed back into the product stream. The oversized material will be piled for disposal. The new conveyor/screen/hopper configuration is shown in Attachment 7.

The aggregate processing and haul road PM10 emissions have also been updated to reflect current EPA recommended emission factors. As a cumulative result of these updates and equipment changes, PM10 emissions are predicted to decrease from previously permitted levels. The NEI will be calculated on the new equipment that has been added to the facility and the reduction in the haul road emissions. The haul road emission reduction is a true reduction because the facility now uses a slurry to transport the sand from the mine to the processing area instead of haul trucks. The reduction in traffic and vehicle weight has resulted in a significant emission reduction.

A new stacker will be added at the dewatering screens and cyclone area off of the slurry line. The stacker will feed a third storage pile which will be east of the existing two storage piles.

(k) **Complete description of all processes by Standard Industrial Classification [SIC]: *(Please attach)***
SIC Code is 1446 – Industrial Sand and Gravel

(l) **Complete description of all Emissions Units by Source Classification Code [SCC]: *(Please attach, an SCC reference document is available upon request)***
Attachment 5

(m) **Type of fuel utilized in each Emissions Unit [If applicable]: *(Please attach)***
The sand dryer is coal fired. Propane is used as a fuel supplement and to trim the fire.

(n) **Estimate of total annual fuel usage from all Non-Road Engines [gasoline and diesel]; Such information may be used by the District for modeling and emission inventory purposes, but shall not be included as a condition in the Authority to Construct: *(Please attach)***
Annual fuel usage for non-road engines has not been inventoried. The annual fuel usage for non-road engines would not be increased due to the current modifications to the facility.

(o) **Maximum Potential to Emit of all Regulated Air Pollutants for each Emissions Unit in [lbs/hr, lbs/day, and ton(s)/yr]: *(Please attach)***

Potential to Emit for each emission unit is presented in Attachment 5 (Emission Section).

Maximum Potential to Emit Emissions of all Regulated Air Pollutants for each Non-Road Engine utilized within a permitted facility in [lbs/hr, lbs/day, and ton(s)/yr]. Such Emissions may be used by the District for modeling and emission inventory purposes and shall not be included in the facility Potential to Emit: *(Please attach)*
Annual fuel usage for non-road engines has not been inventoried. The annual potential to emit for non-road engines would not be increased due to the current modifications to the facility.

(p) **Stack data: location, height above grade, diameter [I.D. or effective], exhaust gasses, flow rate [ACFM], and temperature: *(Please attach)***
Previously submitted modeling parameters for the existing emission units at the facility are still current. The modeling parameters for the replacement baghouse and scrubber will be provided after the equipment as been ordered.

(q) **Maximum rated design production capacity: *(Please attach)***
The maximum rated design production capacity for the facility is a feedrate of 2.04 tons/hour of coal on a rolling 24-hour average. The maximum amount of product through the dryer is 200 tons per hour. The maximum amount of mined material is 400 tons per hour. The maximum production per individual piece of equipment is shown in Table 1.

Table 1 Maximum Design Production Capacity

Source ID	Description	Maximum Production Capacity (ton/hr)	Annual Production Throughputs (ton/yr)
1P	Loader/Mining	400	2,400,000
2P	Grizzly	400	2,400,000
3P	Conveyor	400	2,400,000
4P	Conveyor	400	2,400,000
5P	Scalping Screen	400	2,400,000
6P	Conveyor	400	2,400,000
7P	Conveyor	400	2,400,000
8P	Conveyor	400	2,400,000
9P	Grizzly	400	2,400,000
10P	Conveyor	400	2,400,000
11P	Conveyor	400	2,400,000
12P	Conveyor	400	2,400,000
13P	Rod Deck Screen	400	2,400,000
14P	Conveyor	25	150,000
15P	Conveyor	400	2,400,000
16P	Wet Screen	400	2,400,000
1D	Conveyor	100	400,000
2D	Storage Pile	100	400,000
3D	Conveyor	100	400,000
4D	Storage Pile	100	400,000
5D	Conveyor	100	400,000

6D	Storage Pile	100	400,000
1Y	Loader	200	1,200,000
2Y	Hopper	200	1,200,000
3Y	Conveyor	200	1,200,000
4Y	Conveyor	200	1,200,000
5Y	Conveyor	200	1,200,000
6Y	Conveyor	200	1,200,000
7Y	Screen	200	1,200,000
8Y	Screen	48	288,000
9Y	Screen	48	288,000
10Y	Screen	48	288,000
11Y	Screen	48	288,000
12Y	Screen Reject	10	60,000
13Y	Screen Reject	10	60,000
14Y	Conveyor	190	1,140,000
15Y	Conveyor	190	1,140,000
24Y	Stacker	190	1,140,000
1 Z	Hopper	75	120,000
2 Z	Conveyor	75	120,000
3 Z	Screen	75	120,000
	Coal Feed Rate to the Dryer	2.04 (Based on a 24-Hour Average)	12,708

(r) **Expected production capacity: *(Please attach)***
The expected production capacity is to operate at maximum design capacity. The expected annual production capacity for the facility is an annual consumption of 12,708 tons of coal. The annual production rate for the dryer is 1,200,000 tons of sand. The annual production rate for the mining operations is 2,400,000 tons material mined.

(s) **Schedule of operation [hrs/day, days/wk, wks/yr]: *(Please attach)***
The facility is designed to operate 24 hours a day, 7 days a week, for 52 weeks per year.

(t) **Description of air pollution control equipment, for each Emissions Unit: *(Please attach)***
The proposed scrubber and baghouse are the air pollution control equipment that will be installed for the coal fired dryer. It will control the potential SO2 emissions while fueled with coal of as much as 0.6% sulfur content by 85% and will limit SO2 emissions to 7.34 pph when fueled with coal containing as much as 0.8% sulfur The PM10 emissions will be reduced to 0.025 grains/DSCF as measured by EPA Method 5 and the limit on condensable particulate matter will be based on source testing.

(u) **Analysis of compliance with requirements for Best Available Control Technology [BACT], Lowest Achievable Emission Rate [LAER], Maximum Achievable Control Technology [MACT], as applicable: *(Please attach)***
A full BACT analysis was prepared for the coal fired sand dryer at the Overton facility. The complete BACT analysis is included as Attachment 6. The proposed BACT for the dryer is a baghouse, wet scrubber and low sulfur coal (coal containing no more than 0.8% sulfur).

(v) **Pre-construction measurements of existing air quality, as required by other subsections of Section 12: *(Please attach)***

Not applicable – existing source

(w) Results of modeling for each Regulated Air Pollutant [if applicable]: (*Please attach*)

Modeling is not required by Section 12 since the Net Emission Increase (NEI) for all criteria pollutants is below the modeling thresholds. Table 1 shows the modeling thresholds in Section 12 and the NEI for the facility.

Table 1 Section 12 Modeling Thresholds

Pollutant	NOx (ton/yr)	SOx (ton/yr)	CO (ton/yr)	VOC (ton/yr)	PM10 (ton/yr)
Simplot NEI	**Emission Factor Change**	**-61.23**	**2.48**	**-0.14**	**-20.27**
Modeling Thresholds	40	100	100	40	15
Does Simplot Exceed Thresholds	No	No	No	No	No

However, CH2M HILL is preparing an increment analysis for the triggered criteria pollutants, NOx, PM10, and SOx, in the airshed. Modeling data will be provided to Clark County DAQM upon completion.

(x) Description of post construction ambient air monitoring systems for each Regulated Air Pollutant [if applicable]: (*Please attach*)

Post Construction Monitoring is not required per Section 12. Post construction monitoring is only required when the NEI thresholds for modeling are triggered and the impact concentrations from the facility exceed certain thresholds. As demonstrated in Table 1 the facility does not exceed the modeling thresholds.

(y) Description and general specifications of continuous emissions monitoring systems for each Regulated Air Pollutant, [if applicable]: (*Please attach*)

The facility PTE for CO and SOx is less than 100 tons per year for each pollutant so Continuous Emission Monitoring System (CEMS) requirements have not been triggered for either pollutant. The emission factor change for NOx is not considered to be an NEI since it was a correction in emission factor and not a change in actual emissions.

(z) Additional impact analysis of soils, visibility, vegetation, secondary air quality as required by other subsections of Section 12: (*Please attach*)

Additional impact analysis for soils, visibility, vegetation, and secondary air quality is not required since the NEI is below the thresholds as demonstrated in Table 1.

(aa) Anticipated construction schedule including the estimated initial start-up date:

(*Please attach*)

Simplot plans to order the scrubber and baghouse within 60 days after the ATC is issued. Installation of the equipment will be completed within 6 months of delivery of the equipment.

(bb) Statement of statewide compliance of existing facilities operated by applicant: (*Please attach*)

Simplot Silica does not operate other facilities in the State of Nevada. The J. R. Simplot Company, operates unrelated businesses within the State of Nevada. All are believed to be in compliance.

(cc) **Information on the air pollution control equipment installed at similar facilities owned or operated by the applicant, applicable to sources subject to public notice requirements: *(Please attach)***
Not applicable since Simplot Silica does not operate similar facilities in the State of Nevada.

(dd) **Payment of all applicable fees pursuant to Section 18 of the Department of Air Quality Management Regulations: *(Please attach)***
All applicable fees are included with this application.

In accordance with Section 4.3 of the Clark County Department of Air Quality Management Regulation, and NRS 445.58, the applicant agrees to permit the Control Officer or his representative to inspect the facility during the hours of operation without prior notice.

This application shall be deemed incomplete if submitted information is incorrect, inaccurate or missing.

To the best knowledge of the Responsible Official, the information submitted in this application is certified as true and complete. The Responsible Official agrees that any willful misrepresentation shall be cause for revocation of the Authority to Construct Certificate.

______________________________ ______________
Signature of Responsible Official **Date**

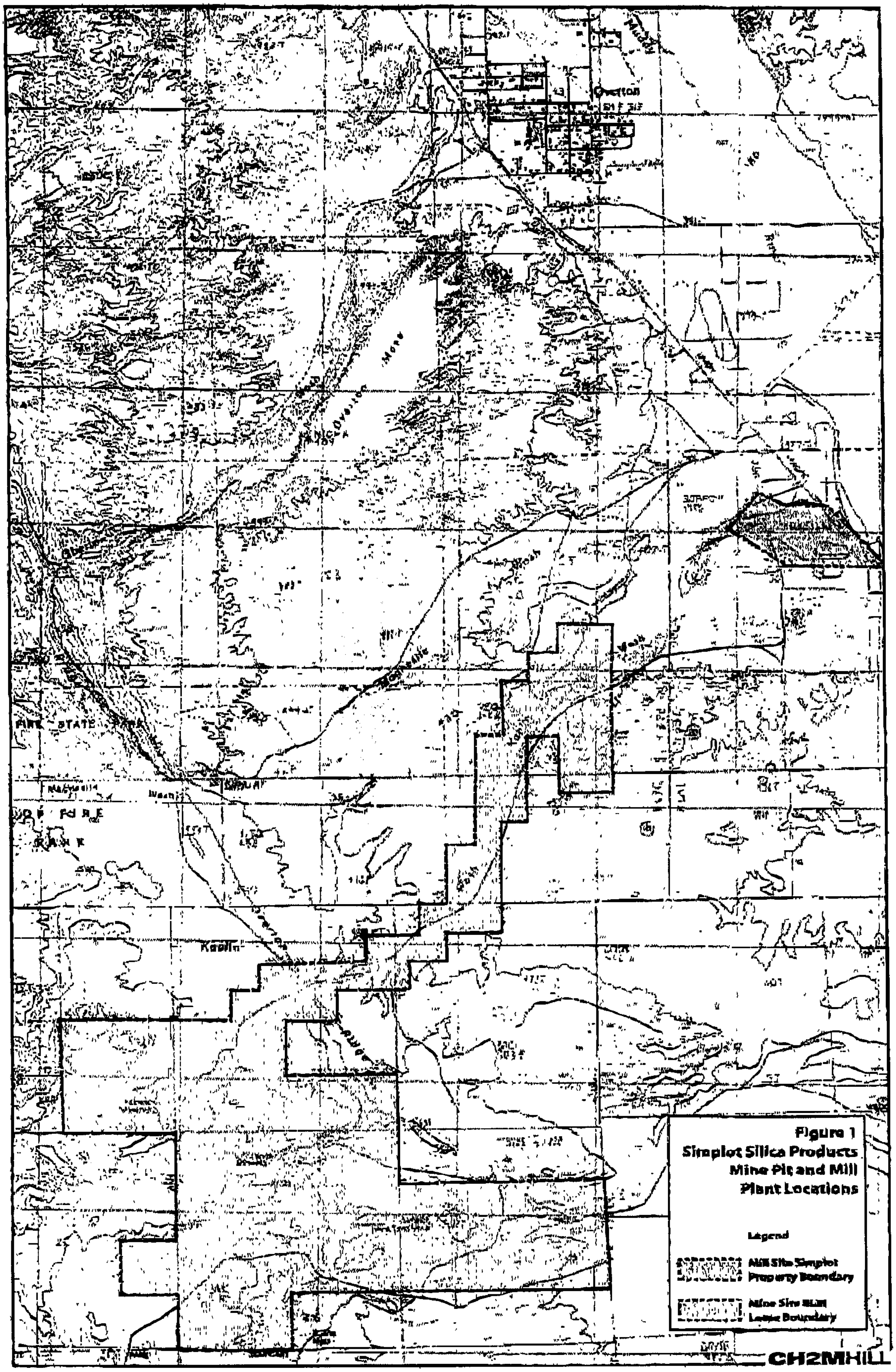
Tom Bender
Printed or Typed Name of Responsible Official

Resident Manager
Responsible Official Title

This application must be accompanied by payment of a $266.00 application filing fee (Make check payable to Clark County Treasurer) in accordance with Section 18 of the Department of Air Quality Management Regulations.

Additional fees may apply. These include a one-time permit review fee, annual equipment fees and possible mitigation obligation.

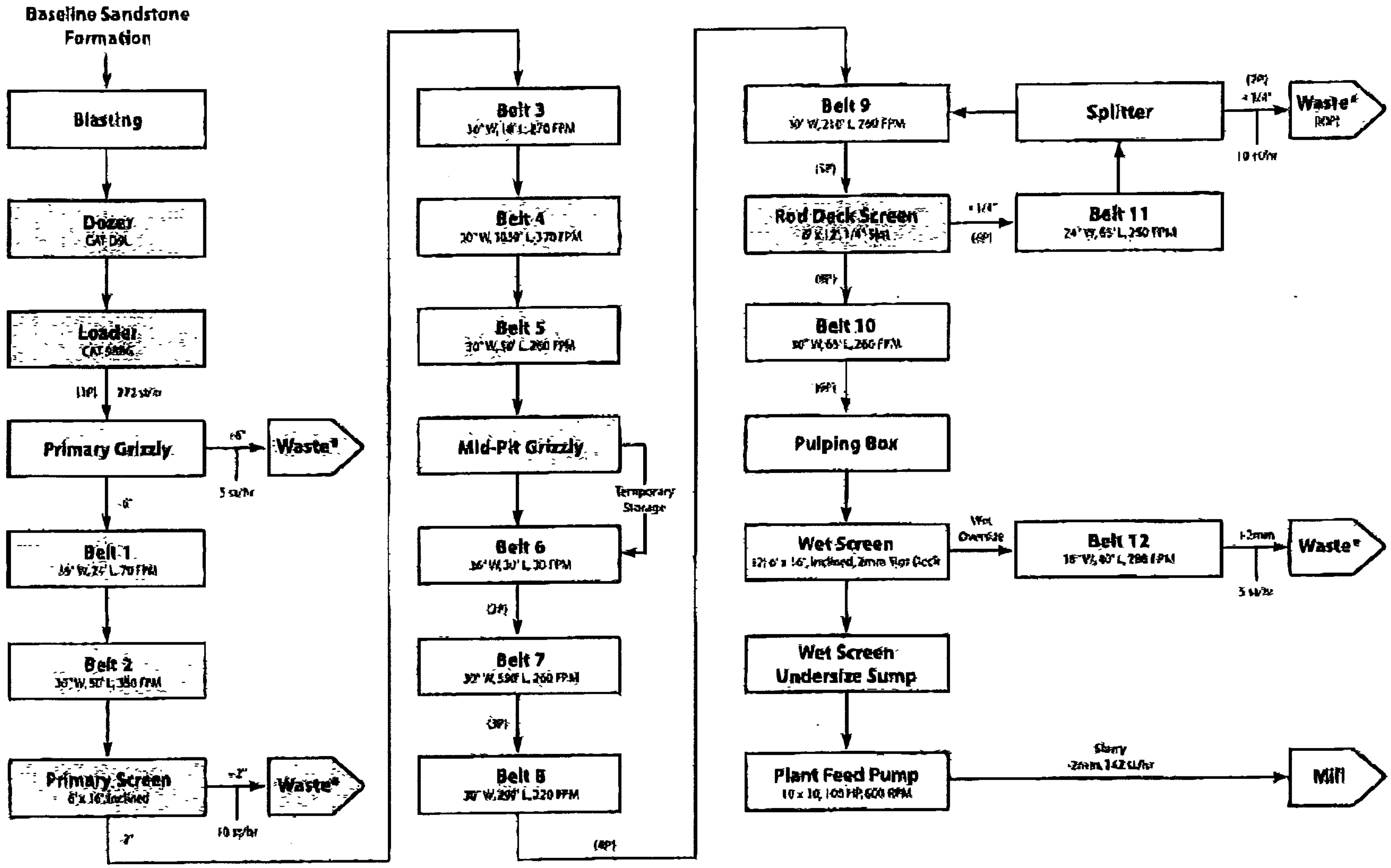
Attachment 1
Stationary Source Location Map


Overton
Kaolin
Figure 1
Simplot Silica Products
Mine Pit and Mill
Plant Locations
Legend
Mill Site Simplot
Property Boundary
Mine Site BLM
Lease Boundary
CH2MHILL

Attachment 2
Site Map

Figure 2 Aerial Photograph of Site Layout

Attachment 3
General Flow Diagram



A01
Mod. 3
A02
A03
Slurry Operations

A01 - Permit Emission Unit(s), No(s).
1P - Pit Transfer Point (Emission Point)
P - Pit

Figure 2
Mine Pit Process Flow Diagram

*From DAQM, "Simplot Silica Products Part 70 OP - TSD (Final Action Report), pgs 36-41

CH2MHILL

Attachment 4
Detailed Flow Diagram

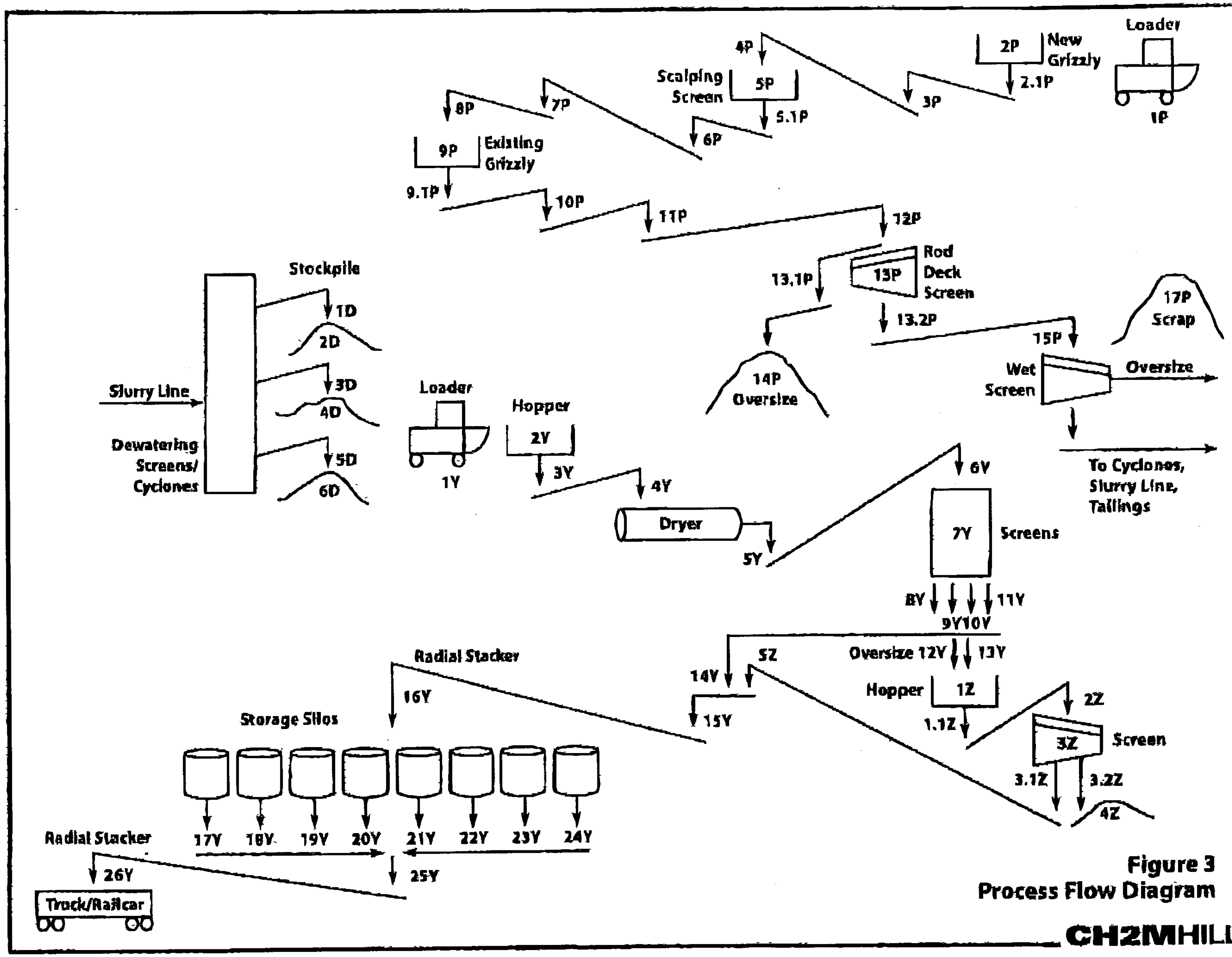


Figure 3
Process Flow Diagram

Attachment 5
Emission Calculations

Facility Emissions

JR Simplot	NOx lb/hr	SOx lb/hr	CO lb/hr	VOC lb/hr	PM10 lb/hr	NOx ton/yr	SOx ton/yr	CO ton/yr	VOC ton/yr	PM10 ton/yr
Controlled	73.78	7.34	1.08	0.55	28.47	231.12	22.87	3.98	0.76	74.43
Uncontrolled	73.78	48.96	1.08	0.553167	283.91	231.12	152.50	3.98	0.76	678.08
				Previously Permitted Limits		220.30	84.10	1.10	0.90	177.80
				Difference		—[1]	-61.21	2.88	-0.14	-20.27
				Modeling Thresholds		40	100	100	40	15
				Exceeds		No	No	No	No	No
				Public Notice Thresholds		40	100	70	70	15
				Exceeds		No	No	No	No	No

1 - NOx was an EF change so there is no NEI
2 - PM10 NEI consist of the reduction in Haul Road emissions and the additional equipment

Aggregate Handling

[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]
1. [illegible]
2. [illegible]

Storage Piles

Wind Erosion
Reference: Control of Open Fugitive Dust Sources, Section 4.1.3, EPA-450/3-88-008
[Wind Emissions From Continuously Active Piles]

E (lb PM per day per a 1.7 (s/1.5) (365-p/235) (f/15)

where:

s = 2.6 silt content %
p = 30 number of days with >0.01 inches precip. per year [from AP-42 Figure 13.2.2-1]
f = 25 percentage of time that wind speed exceeds 5.4 m/s at mean pile height (based on LV windrose
E = 7.0 lb PM per day per acre
E = 3.5 lb PM-10 per day per acre [using PM-10 to PM ratio of 0.5 from EPA-450/3-88-008]

Source ID	Source Name	SCC Code	Stock pile size (acres) (f)	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (tpy)	Control %	Controlled Emissions (lb PM_{10}/hr)	Controlled PM_{10} Emissions (tpy)	Control System
2-D	Sand	3-05-025-07	2.0	0.29	1.28	99	0.003	0.013	Material is at 18% moisture content
4-D	Sand	3-05-025-07	2.0	0.29	1.28	99	0.003	0.013	Material is at 16% moisture content
4-Z	Sand	3-05-026-07	1.0	0.15	0.64	0	0.146	0.639	No Controls
17 P	Sand	3-05-025-07	2.0	0.29	1.28	99	0.003	0.013	Material is at 18% moisture content
	Coal stock pile	3-05-025-07	0.8	0.11	0.48	75	0.027	0.120	Oiled at the mine
14 P	Oversize Pile	3-05-025-07	0.1	0.01	0.06	0	0.015	0.064	No Controls
6-D	Sand	3-05-025-07	2.0	0.29	1.28	99	0.003	0.013	Material is at 18% moisture content

Unpaved Road Emissions

Unpaved Roads emission factor from AP-42, Section 13.2.2: *Unpaved Roads* (9/98), Equation (2) - corrected to account for annual precipitation

E_U (lb per vehicle mile traveled) = ((k(s/12)^a(W/3)^b)/(M/0.2)^c)((365-p)/365)

where:

k = 2.6	[Table 13.2.2-2, for PM_{10}]	
k = 10	[Table 13.2.2-2, for PM]	
s = 12	[silt loading (%) for sand and gravel processing plant road, Table 13.2.2-1]	
a = 0.8	[Table 13.2.2-2, for PM_{10}]	
W = 3	[mean vehicle weight(tons)]	[3- ton pick up trucks]
b = 0.4	[Table 13.2.2-2, for PM_{10}]	
M= 0.45	[default value for moisture in the soil (%); dry, uncontrolled conditions]	
c = 0.3	[Table 13.2.2-2, for PM_{10}]	
p= 30	[annual precipitation (days), Figure 13.2.2-1]	
E_U = 1.591	[PM_{10}]	
E_U = 6.119	[PM]	

Vechicle Traffic hours per day =	16 hours
Haul road round trip =	8.00 miles
Round trips per hour =	1.50
Round trips per year =	8,760
VMT (per hour) =	12.0 miles
VMT (annual) =	70,080 miles

Source ID	Source Name	SCC Code	Maximum Uncontrolled Emissions (lb PM/hr)	Maximum Uncontrolled Emissions (lb PM_{10}/hr)	Annual Uncontrolled PM_{10} Emissions (tpy)	Control %	Maximum Controlled Emissions (lb PM_{10}/hr)	Annual Controlled PM_{10} Emissions (tpy)	Control System
	Unpaved haul roads	3-05-025-04	73.42	19.09	55.74	75.00	4.77	13.94	Water Sprays

Dryer Emissions

Emission Unit Dryer	SCC Code	NOx lb/hr	SOx[1] lb/hr	Uncontrolled SOx[1] lb/hr	CO lb/hr	VOC lb/hr	PM10[2] lb/hr	Uncontrolled PM10[2] lb/hr	NOx ton/yr	SOx ton/yr	Uncontrolled SOx ton/yr	CO ton/yr	VOC ton/yr	PM10 ton/yr	Uncontrolled PM10 ton/yr
Coal Fired	3-05-025-08	73.44	7.34	48.96	1.02	0.22	12.09	22.29	228.74	22.87	152.50	3.18	0.70	37.64	60.41
Propane	3-05-025-08	0.34	0.00		0.06	0.33	0.01	0.01	2.38	0.00	0.00	0.40	0.06	0.08	0.08
	TOTAL	73.78	7.34	48.96	1.08	0.55	12.10	22.30	231.12	22.87	152.50	3.58	0.76	37.72	60.49

1 - 85% Control Efficiency Applied (Baghouse/Scrubber)
2 - 95% Control Efficiency Applied (Baghouse)

04/16/1998 Performance Test
Feed rate - 1.48 tons of coal/hr
NOx - 48.05 lbs/hr
SOx - 18.1 lb/hr
CO - 0.2 lb/hr
VOC - 0.2 lb/hr
PM10 - 2.21 lb/hr

04/04/2000 Performance Test
Feed Rate - 1.57 tons of coal/hr
SOx - 15.4 lb/hr
PM10 - 4.91 lb/hr

Propane Emissions - AP-42 Section 1.5 Liquefied Petroleum Gas Combustion
NOx - 19 lb/10^3 gallons
SOx - .018 lb/10^3 gallons
CO - 3.2 lb/10^3 gallons
VOC - 0.5 lb/10^3 gallons
PM10 - 0.8 lb/10^3 gallons

Dryer HAPS Emissions

HAP	CAS Number	EF lb/ton	Emissions lb/hr	Emissions ton/year
Acetaldehyde	75070	5.70E-04	1.16E-03	3.62E-03
Acetophenone	98862	1.50E-05	3.06E-05	9.53E-05
Acrolein	107028	2.90E-04	5.92E-04	1.84E-03
Benzene	71432	1.30E-03	2.65E-03	8.26E-03
Benzly Chloride	100447	7.00E-04	1.43E-03	4.45E-03
Bis (2-ethylhexyl)phthalate (DEHP)	117817	7.30E-05	1.49E-04	4.64E-04
Bromoform	75252	3.90E-05	7.96E-05	2.48E-04
Carbon Disulfide	75150	1.03E-04	2.10E-04	6.54E-04
2-Chloroacetophenone	532274	7.00E-06	1.43E-05	4.45E-05
Chlorobenzene	108907	2.20E-05	4.49E-05	1.40E-04
Chloroform	67663	5.90E-05	1.20E-04	3.75E-04
Cumene	98828	5.30E-06	1.08E-05	3.37E-05
2,4-Dinitrotoluene	121142	2.80E-07	5.71E-07	1.78E-06
Dimethyl Sulfate	77781	4.80E-05	9.79E-05	3.05E-04
Ethyl benzene	100414	9.40E-05	1.92E-04	5.97E-04
Ethyl Chloride	75003	4.20E-05	8.57E-05	2.67E-04
Ethylene Dichloride	107062	4.00E-05	8.16E-05	2.54E-04
Ethylene Dibromide	106934	1.20E-06	2.45E-06	7.62E-06
Formaldehyde	50000	2.40E-04	4.90E-04	1.52E-03
Hexane	110543	6.70E-05	1.37E-04	4.26E-04
Isophorone	78591	5.80E-04	1.18E-03	3.69E-03
Methyl Bromide	74839	1.60E-04	3.26E-04	1.02E-03
Methyl Chloride	74873	5.30E-04	1.08E-03	3.37E-03
Methyl Ethyl Ketone	78933	3.90E-04	7.96E-04	2.48E-03
Methyl Hydrazine	60344	1.70E-04	3.47E-04	1.08E-03
Methyl Methacrylate	80626	2.00E-05	4.08E-05	1.27E-04
Methyl Tert Butyl ether	1634044	3.50E-05	7.14E-05	2.22E-04
Methylene Chloride	75092	2.90E-04	5.92E-04	1.84E-03
Phenol	108952	1.60E-05	3.26E-05	1.02E-04
Propionaldehyde	123386	3.80E-04	7.75E-04	2.41E-03
Tetrachloroethylene	127184	4.30E-05	8.77E-05	2.73E-04
Toluene	108883	2.40E-04	4.90E-04	1.52E-03
1,1,1-Trichloroethane	79005	2.00E-05	4.08E-05	1.27E-04
Styrene	100425	2.50E-05	5.10E-05	1.59E-04
Xylenes	1330207	3.70E-05	7.55E-05	2.35E-04
Vinyl Acetate	10054	7.60E-06	1.55E-05	4.83E-05
Antimony		1.80E-05	3.67E-05	1.14E-04
Arsenic		4.10E-04	8.36E-04	2.61E-03
Beryllium		2.10E-05	4.28E-05	1.33E-04
Cadium		5.10E-05	1.04E-04	3.24E-04
Chromium		2.60E-04	5.30E-04	1.65E-03
Cobalt		1.00E-04	2.04E-04	6.35E-04
Lead		4.20E-04	8.57E-04	2.67E-03
Manganese		4.90E-04	1.00E-03	3.11E-03
Mercury		8.30E-05	1.69E-04	5.27E-04
Nickel		2.80E-04	5.71E-04	1.78E-03
Selenium		1.30E-03	2.65E-03	8.26E-03
	TOTAL		2.06E-02	6.41E-02

Attachment 6
BACT Determination

SULFUR DIOXIDE BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS FOR 2003

SIMPLOT SILICA PRODUCTS SAND DRYER OVERTON, NEVADA

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August 2003

SULFUR DIOXIDE BACT ANALYSES FOR THE SIMPLOT SILICA SAND DRYER OPERATION IN OVERTON, NEVADA

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BACT ANALYSES FOR SULFUR DIOXIDE

Best Available Control Technology (BACT) is an emission limitation based on the maximum degree of reduction that is achievable taking into account energy, environmental. and economic impacts. The "top-down" process requires that all available control technologies be ranked in descending order of control effectiveness. The most stringent technology is then selected as BACT unless the applicant demonstrates to the permitting authority that technology considerations, or energy, or environmental, or economic impacts justify a conclusion that the most stringent technology is not "achievable". In this case the next most stringent technology is analyzed until the applicant can no longer justify to the permitting agency that the technology is not "achievable".

The steps taken to conduct the SO_2 BACT analysis for the Simplot Silica Products sand dryer at Overton, Nevada are:

1. Review BACT determinations for recent permits and other sources to identify potentially applicable controls for the sand dryer;
2. Discuss the application of potential controls to the sand dryer and eliminate controls that are not technically feasible;
3. Rank the technically feasible controls in order of highest level of control (lowest emission rate) to lowest level of control (highest emission rate);
4. Develop the environmental, energy, and economic impacts of each control system ranked in step 3; and
5. Select the most stringent control system that has acceptable environmental, energy, and economic impacts.

The following sections discuss the results of each of these steps.

1. Permit/Technology Reviews

To identify the typical BACT and associated emission limits used to control sulfur dioxide (SO_2) emissions from the mineral processing industry, the Environmental Protection Agency's RACT/BACT/LAER Clearinghouse data base (RBLC) was searched for BACT determinations on dryers and kilns. The results of this review were used to identify the most stringent control technologies and the accompanying control efficiencies and BACT emission limits.

The RBLC database was searched for BACT determinations in the Mineral Processing Industry (process category 90). A search was first conducted for the non-metallic minerals processing sector (process category 90.024). However, no permits were listed that had SO_2 as a pollutant with permit limits. Then the search was broadened to include Calciners & Dryers Mineral Processing Facilities (process category 90.017). The results of these searches covering the 1989 through 2002 RBLC time period are presented in Table 1.

Table 1. Summary of RBLC Review 1989 through 2002

RBLCID	Facility	State	Permit Date	Process	SO_2 Control Description	SO_2 Limits	SO_2 Limit Type
AL-0035	Big River Industry	Alabama	02-06-89	Lt Aggregate Kiln	1.5% sulfur coal wet scrubber - 80 %	145 lb/hr	Other
NV-0032	Great Star Corp.	Nevada	10-18-93	Cement Kiln/calciner	1% sulfur coal	208 tpy	BACT-PSD
CA-0651	A&M Products	California	04-13-95	Rotary Aggregate Dryer	Fuel spec, LPG firing	3.7 lbs/d	BACT-other
CA-0729	Basalt Block	California	06-21-97	Sand Dryer	Natural gas fuel	None	None
AR-0025	Texasgulf Soda Ash Plant	Arkansas	10-17-97	Aggregate Kiln	Natural gas and wet scrubber	4.9 tpy	BACT-PSD
CA-0808	Celite Corporation	California	12-03-97	Diatomaceous Earth Calciner	Gas Adsorption Tower	98% Removal	LAER

As Table 1 shows, the RBLC review of the time period identified one sand dryer permit, three aggregate dryer permits, one diatomaceous earth dryer permit, and one cement kiln/calciner permit. Note only the cement (alkaline feed) kilns/calciners permitted in Nevada was listed from the Calciners & Dryers process category search to identify regional BACT determinations and limits. This is because these kilns/calciners process highly alkaline material that readily absorbs SO_2 from fuel combustion. This is not the case for sand and aggregate dryers where alkaline material must be purchased for SO_2 abatement. The Nevada permit for cement kilns was included to identify regional BACT determinations and limits to see if these determinations were consistent with controls applied to the Simplot Silica sand dryer. For the cement kiln/calciner (NV-

0032), low sulfur coal was specifically identified as BACT for SO_2 and the permitted emission rate is 208 tons per year.

The sand dryer permit did not contain BACT determinations/limits for SO_2 presumably because the emissions of SO_2 were less than 40 tons per year (PSD significance level) due to firing a very low sulfur fuel (natural gas). The sand dryer was permitted in California where the use of coal is limited due to PM_{10} non- attainment issues. This was the case for the 15 ton per hour aggregate dryer permit (CA-0653). A&M Products was contacted regarding the use of liquified petroleum gas (LPG) instead of coal or oil, and regarding what BACT-Other for SO_2 referred to in the RBLC listing. The plant engineer said that they had recently installed a fluid bed dryer firing natural gas. No aggregate dryers had been built recently, although one was removed when the fluid bed dryer was installed. He said he was not aware of anyone in the San Joaquin Valley Unified Air Quality Management District-Southern Region getting permits to burn coal due to the PM_{10} non-attainment status of the area.

The Alabama permit (AL-0035) was not a BACT determination. As such, information on this permit was not pursued further. However, it should be noted that the permitted emission rate is much higher than the permitted emissions from Simplot's sand dryer (145 lb/hr versus 19.2 lb/hr from 1988 permitting action); the permitted coal sulfur content is higher than for Simplot's sand dryer (1.5% versus 0.6%), and the overall control efficiencies including coal sulfur content are comparable.

Although the number of RBLC permits issued in the 1989 to 2002 time frame is small, the results are consistent with the RBLC review conducted for the 1980's. The results of the 1980's RBLC review are presented in the report *Sulfer Dioxide Best Avaialable Control Technology Analyses For 1982 & 1988 Simplot Silica Products Sand Dryer Overton, Nevada*, submitted to U.S. EPA on January 31, 2000.

II. Technology Review of SO_2 Control

The purpose of this subsection is to provide the technical feasibility basis for the SO_2 control technology hierarchy that will be evaluated for BACT for SO_2. Based on the RBLC review for SO_2 BACT determinations from 1989 through 2002, only fuel sulfur specifications/limitations are identified as BACT. Other controls known to control SO_2 from combustion sources include wet scrubbing, dry scrubbing, and sorbent injection. Each of these technologies is described briefly below.

A. Fuel Sulfur Specification

The primary method for controlling emissions of SO_2 from sand/aggregate dryers is specifying the fuel and fuel sulfur content. The use of low sulfur coals for limiting SO_2 emissions from industrial sources in the western states is economically attractive since most of the western coals economically available for industrial users have low sulfur contents (less than 1% sulfur). Other low sulfur fuels potentially available include fuel oil, natural gas, and LPG. There are no natural gas pipelines in Overton, NV, eliminating natural gas as a fuel choice. Fuel oil with a sulfur content of 1 wt % sulfur was used in the original three sand dryers replaced in 1982 by the coal-fired sand dryer because coal was significantly lower in cost than fuel oil.

When selecting a fuel, the key words are "economically available". The single largest annual cost of operating the sand dryer is fuel cost. As such, the choice of fuel and related pollution controls has significant impacts on project economic viability. After all, any fuel can be made available at some price but for many fuels this price makes the project uneconomical to consider. For example, fuels such as natural gas and LPG are really not economically available in Overton, NV in the quantities needed by the coal-fired sand dryer. For the Simplot Silica location and fuel consumption needs, coal is much more economical than fuel oil, natural gas, and LPG. For example, the current cost of coal delivered to Overton, NV is $1.72/MMBtu, and the current cost of propane delivered to Overton, NV is $6.56/MMBtu. This difference in fuel costs ($4.84/MMBtu) equates to a potential increase in annual fuel cost of $2,360.000/year. This annual cost increase is over twice that of the annual cost of wet scrubbing control (the highest cost control option). As such, only coal was considered to be economically feasible in this BACT analysis excluding the use of natural gas, LPG (propane/butane), and low sulfur No.2 fuel oil as SO_2 control options.

B. SO_2 Scrubbing

The primary methods for scrubbing SO_2 from combustion source flue gases are wet scrubbing, dry scrubbing, and sorbent injection scrubbing. Wet scrubbers contact the flue gas with an alkaline water solution created by dissolving either lime/limestone or soda ash/caustic in water. When lime or limestone is used, the absorbed SO_2 becomes calcium salts ($CaSO_4$ and $CaSO_3$) which are disposed of in settling ponds or are separated from the water and landfill operations. When soda ash or caustic is used, the absorbed SO_2 becomes sodium salts (Na_2SO_4) which are disposed of by discharge to the wastewater treatment system or disposed of in evaporation ponds.

Dry scrubbers contact the flue gas with an alkaline/water spray, which dries to a solid before leaving the spray vessel. Sorbent injection contacts the flue gas with a solid sorbent, such as lime or soda ash. The dry solids from the dry scrubbing and sorbent injection processes are captured in a particulate control device (baghouse or electrostatic precipitator) before the flue gas exits to the atmosphere. The dry solid waste containing reacted and unreacted sorbent is generally disposed of as a solid waste but can be sluiced to disposal ponds. Another control option similar to spray drying and sorbent injection is the use of the inherent alkaline materials found in coal ash and sand to absorb some of the SO_2. This is what happens when particulates from the sand dryer are captured in a baghouse. The alkalinity contained in the captured particles will absorb SO_2 in the flue gas up to the point that the alkaline material is used up or removed from the flue gas stream by the bag cleaning cycle.

The use of wet or dry scrubbing for significant sources of SO_2 emissions is required by NSPS and by PSD-BACT determinations for large, coal- and fuel oil- fired steam boilers. Operational problems historically associated with wet scrubbers using lime or limestone addition to maintain the scrubbing solution pH levels are much better understood and current scrubber designs are much more reliable than in the past. [EPA/625/1-85/019, page iii]

Since the baghouse will follow the proposed SO_2 control, it is paramount that the solids in the scrubbing media be minimized to prevent/minimize the potential for any carry over into the exhaust stream. The use of caustic will be the first choice of reagent in order to minimize the introduction of solids. Limestone will be the alternative reagent if caustics are not available or economically not viable.

III. SO_2 BACT Hierarchy

Based on the above technology discussion the BACT hierarchy will include wet scrubber (scrubbing), lime spray dryer scrubbing, lime sorbent injection scrubbing, and use of low sulfur coal (coals having a sulfur content of < 1.0 wt %). Fuel oil, natural gas, and LPG are not economically viable in Overton, NV. The proposed BACT hierarchy is:

1. Coal sulfur content of 0.6% and wet scrubber @ 85% SO_2 control;
2. Coal sulfur content of 0.6% and Lime spray dryer scrubbing @ 75 & 80% control;
3. Coal sulfur content of 0.6% and dry lime sorbent injection scrubbing @ 45 & 65% control; and
4. Coal sulfur content of 0.6% and baghouse at 0% and 25% control (baseline).

The use of 0.6% sulfur coal and baghouses for PM/PM_{10} control was considered as the baseline for this SO_2 BACT. This is because the RBLC research identified the use of baghouse/fabric filtration as BACT for PM/PM_{10}, and the use of baghouse/fabric filtration has been considered as BACT for PM/PM_{10} control in Clark County, NV. The use of very low sulfur coal is considered as baseline because the sulfur content of the coal used since start up of the coal-fired sand dryer in 1982 by Simplot is below 0.6% sulfur, and the use of these coals is anticipated to be economically practical at Simplot's Overton, NV facility in the future.

A. Wet scrubber Scrubbing

This scenario consists of an absorber preceded by a baghouse. In general, lime wet scrubbers are capable of up to 95% control with careful design and operation. Removals of 90% are more common.[See EPA-600/7-90-018 page 2-43 in Appendix C] As such. lime wet scrubbing is considered the most stringent SO_2 control scenario. A conservative SO_2 removal of 85% is assumed.

B. Lime Spray Dryer Scrubbing

This scenario consists of a lime spray dryer/absorber followed by a baghouse. In general, lime spray dryer/absorber scrubbers have control efficiencies of 60 to 90 % [See EPA-600/7-90-018 page 2-61 in Appendix C]. An SO_2 removal efficiency of 80% is anticipated for this system based on a vendor quotation.[See Appendix B] A lower control efficiency of 75% is also evaluated assuming the same capital and annual costs as the 80% control vendor quotation. The 75% control scenario is evaluated because of the low SO_2 concentration entering the scrubber and the cycling nature of the sand dryer operation negatively affect the scrubbers potential control efficiency. Since the actual control efficiency can only be determined after installation and operation of the system, the final permit limit (lb/hr of SO_2) should be based on an analysis of actual data with constraints on the amount of sorbent injected to keep operating cost impacts and waste disposal impacts consistent with this analysis.

C. Dry Lime Injection Scrubbing

This control scenario consists of dry lime injection in the flue gas ducting before the baghouse. In general, dry lime injection systems have control efficiencies of 40 to 75 %.[See EPA-600/7-90-018 page 3-48 in Appendix C] The performance of this technology is very site specific. As such, two control efficiency scenarios were evaluated; one at 45% control and one at 65% control. Since the actual control efficiency can only be determined after installation and operation of the system, the final permit limit (lb/hr of SO_2) should be based on an analysis of actual data with constraints on the amount of sorbent injected to keep operating cost impacts and waste disposal impacts consistent with this analysis.

D. Baghouse Control

This control scenario consists of a baghouse (no lime or other alkaline injection). Some SO_2 removal will potentially occur in the baghouse because of the alkaline nature of the coal ash. and the alkaline nature of impurities with the sand (sand itself is not alkaline in nature). However, the quantity of sand impurities varies with the effectiveness of the sand cleaning operation at the mine. As such, the amount of inherent SO_2 removal will vary based on the availability/amount of alkaline impurities coming in with the wet sand. For purposes of this analysis, an anticipated inherent SO_2 control of 0% and 25% were assumed. The 25% scenario is based on Simplot's 1996 test data showing of 26% SO_2 removal. Testing in 2000 indicated 37% SO2 removal. Because this testing result is only for one time period, it is not known how representative the assumption of 25% SO_2 is with operation over time. Thus, a range in control efficiency from 0% to 25% was established. Since the actual control efficiency can only be determined after installation and operation of the system, the final permit limit (lb/hr of SO_2) should be based on an analysis of actual data.

IV. SO_2 BACT Impacts Analyses

This subsection presents the emission and cost impacts, and energy and environmental impacts.

A. Emission and Cost Impacts

Table 2 summarizes the emissions and economic impact analyses. The estimated controlled SO_2 emissions range from 23 TPY (85% control) to 114 TPY (25% control). The difference between controlled SO_2 emissions comparing the different control options is significant. Appendix A documents the emission calculations.

Table 2. Summary of 2003 BACT Emissions and Economic Impacts (0.6% Sulfur Coal)

Sand Dryer Impacts	Baghouse (1)		Dry Lime Injection		Lime Spray Drying	Wet Scrubber
SO_2 Emissions	0% control	25% control	45% control	65% control	80% control	85% control
- lb/hr	49.0	36.7	26.9	17.1	9.8	7.3
- tpy	153	114	84	53	30	23
Economic (2)						
- Capital costs	$827,000		$1,405,000		$2,461,000	$2,927,000
Incremental			$578,000		$1,630,000	$2,100,000
- Annual costs	$381,000		$565,000		$1,234,000	$1,313,000
Incremental			$184,00		$853,000	$932,000
Cost-effectiveness vs baseline (3)						
- @ 0% control			$2,667/ton	$1,840/ton	$6,935ton	$7,169/ton
- @ 25% control			$6,133/ton	$3016/ton	$10,155/ton	$10,242/ton

NOTES: (1) Baseline- baghouse required for PM/PM_{10} control; (2) All capital and annual costs are in 2000 dollars, rounded to the nearest $1,000; (3) Cost-effectiveness--$/ton of air contaminant removed, relative to baseline; (4)) Incremental Cost-effectiveness--$/ton of air contaminant removed between two control options.

Incremental capital costs over baseline (baghouse) for the control of SO_2 ranged from $ 578,000 (dry lime injection) to $ 2,100,000 (Wet Scrubber). Incremental annual costs over baseline for the control of SO_2 ranges from $ 565,000 (dry lime injection) to $ 932,000 (wet scrubber). The bases for the above cost estimates are documented in Appendix B.

B. Energy and Environmental Impacts

Table 3 summarizes the energy and secondary environmental impacts analyses for the SO_2 controls. Incremental energy impacts range from 641,000 kW-hrs/yr (dry lime injection) to 2,920,000 kW-hrs/yr (wet scrubber). The lime spray dryer and wet scrubber option have very significant energy requirements over dry lime injection control.

Lime spray drying also requires 129,000 MMBtu/yr for maintaining the sand dryer flue gas near 400 °F. This is necessary for proper drying of the lime slurry sprayed into the flue gas for maximum SO_2 removal and to prevent caking of damp solids on the fabric filter bags. The coal-fired sand dryer outlet temperature in approximately 225 °F. It is assumed for this analysis that the higher sand dryer outlet temperature would be accomplished by burning more coal per ton of sand. If propane is used the cost impacts will increase from about $220.000/yr to $850,000/yr.

The waste disposal amounts (tons/yr) are for dry waste and do not include water retained in the waste in the disposal ponds. The dry lime injection option has the largest amount of solid waste due to the high lime to SO_2 ratio required for this technology relative to the other scrubbing options.

The process water requirements include water evaporated in the lime spray dryer and wet lime scrubbers, water required for the lime slaking/slurry operations, and water for sluicing the solid wastes from the baghouse. Process water use is a resource drain on the environment. Sluice water is required to transport all solid wastes to the disposal ponds and is a facility recycle stream. The environmental cost of sluice water is tied to pumping power requirements. Relative to the amount of mined material and associated processing/sluicing water, the solid waste and water impacts of the SO_2 control hierarchy are not significantly different.

Table 3. Summary of 2003 BACT Energy and Environmental Impacts (1)

Sand Dryer Impacts	0.6 % Sulfur Coal & Baghouse (2)	Dry Lime Injection @ 45%	Dry Lime Injection @ 65%	Lime Spray Dryer @ 80%	Wet scrubber @ 85%
Energy					
- kW-hrs/yr	772,000	1,413,000		2,362,000	3,692,000
Incremental		641,000		1,590,000	2,920,000
-millions Btu/yr	None	None		129,000	none
Secondary Environmental					
-waste (tons/yr) (3)	3,570	8,180		6,760	6,190
Incremental		4,610		3,190	2,620
- sluice water (gallons/yr)	2,850,000	6,530,000		5,400,000	5,370,000
Incremental		3,680,000		2,550,000	2,520,000
- process water (gallons/yr) (5)	28,000	64,800		---	475,000
Incremental		36,800		---	447,000

(1) All impacts have been rounded to three significant figures; (2) Baseline- baghouse required for PM/PM_{10} control; (3) The waste tons per year does not include water; (4) sluice water is a recycle stream with in the facility; (5) Process water includes water volume for wetting baghouse solids and the lime slurry water required for lime spray dryer and wet scrubber. Process water use increases the facilities water consumption.

V. SO_2 BACT Selection

Because only the emission and economic impacts were found to be significantly different between the control hierarchy options, energy and secondary environmental impacts will not be discussed further.

A. Emission impacts

For the SO_2 control hierarchy, the SO_2 emission reductions, total emissions, and percent reduction vary significantly for this source of SO_2 emissions.

B. Economic Impacts

Economic impacts are typically evaluated looking at the changes in annual costs, the cost per ton of air contaminant removed, and what other state agencies have identified as cost effective controls for similar processes. The total annual cost review assesses the economic impact to the project of the control option. The cost per ton of air contaminant removed (cost-effectiveness) is useful when comparing information from other similar sources. And, the RBLC review results are an indicator of control technologies that the state agencies considered cost-feasible for BACT during the permitting time period.

With respect to the annual cost of control, the wet scrubber control has reasonable economic impact on the sand dryer operation assuming that a baghouse is the best option for PM/PM_{10}. The baghouse control option for PM/PM_{10} control only has a capital cost of \$1,100,000, and an annual cost of \$408,000/yr. These costs are not included in the SO_2 control scenarios since all scenarios would include a baghouse for PM/PM_{10} control. With respect to SO_2 control, the most stringent control has been selected so no further analysis of economic impacts are required.

C. SO_2 BACT Selection

- Based on economic and emission impacts, the use of low sulfur coal (0.6% S) with baghouse, and wet scrubber is proposed as BACT for SO_2.

V. CONCLUSIONS

- Based on this BACT analysis for SO_2 emissions from the Simplot Silica Products sand dryer, it is concluded that the use of low sulfur coal (0.6% S) with baghouse and wet scrubber is BACT for SO_2.
- Since the actual control efficiency can only be determined after installation and operation of the system, the final permit limit (lb/hr of SO_2) will be based on an analysis of actual data with constraints on the amount of sorbent injected to keep operating cost impacts and waste disposal impacts reasonable. Subject to performance testing, the proposed SO_2 emission limit would be 7.34 lb/hr.

- The lb/hr emission limit will be monitored by periodic stack testing using appropriate U.S. EPA reference methods. The stack testing will occur in five year intervals. The lb/hr emission limit will routinely (monthly) be determined by combining the coal feed rate (from the VFD on the coal feed), the sulfur content of the coal (monthly composite analysis from the mine) and the 85% removal factor.
- The proposed BACT technology and emission limits are more stringent than permit determinations found in the RBLC database, and the NSPS for small industrial boilers.[See 40 CFR 60.40c in Appendix C] The small industrial boiler NSPS was reviewed because the NSPS for minerals processing does not address dryer combustion emissions.

ATTACHMENT A

EMISSIONS & COST EFFECITIVENESS CALCULATIONS

EMISSION AND COST EFFECTIVENESS CALCULATIONS

SO2 BACT IMPACTS ANALYSES FOR 2000 - Baseline 0% Control

Sand Dryer impacts	0.6 % Sulfur Coal & Baghouse		Dry Lime Injection		Dry Lime Injection		Lime Spray Dryer		Wet Scrubber	
SO2 Emissions	0%	=1-(49/49) * 100	45%	=1-(27/49) * 100	65%	=1-(17.2/49) * 100	80%	=1-(9.8/49) * 100	85%	=1-(7.4/49) * 100
- lb/hr	49.0	=49lb/hr	27.0	49lb/hr * 0.55 control fraction	17.2	=49lb/hr * 0.35 control fraction	9.8	=49lb/hr * 0.20 control fraction	7.4	=49lb/hr * 0.15 control fraction
- tpy	153	=49 lb/hr*6230 hr/yr / 2000 lb/ton	84	=27 lb/hr*6230 hr/yr / 2000 lb/ton	53	=17.2 lb/hr*6230 hr/yr / 2000 lb/ton	31	=9.8 lb/hr*6230 hr/yr / 2000 lb/ton	23	=7.4 lb/hr*6230 hr/yr / 2000 lb/ton
Economic										
- Capital costs	$527,000	see Appendix B	$1,495,000	see Appendix B	$1,494,000	see Appendix B	$3,451,000	see Appendix B	$3,987,000	see Appendix B
- Annual costs	$381,000	see Appendix B	$565,000	see Appendix B	$565,000	see Appendix B	$1,234,000	see Appendix B	$1,313,000	see Appendix B
Cost-effectiveness										
- $/ton vs baseline			$2,679	=($565,000-$381,000)/(252-105)	$1,965	=($564,000-$381,000)/(252-88)	$4,986	=($1,234,000-$381,000)/(252-50)	$7,184	=($1,313,000-$381,000)/(252-25)
- $/ton vs Dry Lime Injection @ 45%							$12,573	=($1,234,000-$565,000)/(135-38)	$12,251	=($1,313,000-$565,000)/(139-25)
- $/ton vs Dry Lime Injection @ 65%							$39,220	=($1,234,000-$566,000)/(88-38)	$24,503	=($1,313,000-$565,000)/(88-25)

SO2 BACT IMPACTS ANALYSES FOR 2000 - Baseline 25% Control

Sand Dryer impacts	0.6 % Sulfur Coal & Baghouse		Dry Lime Injection		Dry Lime Injection		Lime Spray Dryer		Wet Scrubber	
SO2 Emissions	25%	=1-(36.75/49) * 100	55%	=1-(22.05/49) * 100	70%	=1-(20.2/49) * 100	80%	=1-(8.857/49) * 100	85%	=1-(5.857/49) * 100
- lb/hr	36.7	=49lb/hr * (0.75) control fraction	27.0	=49lb/hr * (0.55) control fraction	17.2	=49lb/hr * (0.6 * 0.35) control fraction	9.8	=49lb/hr * (0.6 * 0.20) control fraction	7.4	=49lb/hr * (0.6 * 0.15) control fraction
- tpy	114	=36.7 lb/hr*6230 hr/yr / 2000 lb/ton	84	=27 lb/hr*6230 hr/yr / 2000 lb/ton	63	=17.2 lb/hr*6230 hr/yr / 2000 lb/ton	31	=9.8 lb/hr*6230 hr/yr / 2000 lb/ton	23	=7.4 lb/hr*6230 hr/yr / 2000 lb/ton
Economic										
- Capital costs	$527,000	see Appendix B	$1,405,000	see Appendix B	$1,405,000	see Appendix B	$3,451,000	see Appendix B	$3,987,000	see Appendix B
- Annual costs	$381,000	see Appendix B	$565,000	see Appendix B	$565,000	see Appendix B	$1,234,000	see Appendix B	$1,315,000	see Appendix B
Cost-effectiveness										
- $/ton vs baseline			$6,058	=($565,000-$381,000)/(183-139)	$3,021	=($565,000-$381,000)/(183-88)	$10,180	=($1,234,000-$381,000)/(183-38)	$10,184	=($1,313,000-$381,000)/(183-25)
- $/ton vs Dry Lime Injection @ 45%							$12,539	=($1,234,000-$565,000)/(139-38)	$12,251	=($1,313,000-$565,000)/(139-25)
- $/ton vs Dry Lime Injection @ 65%							$29,229	=($1,234,000-$565,000)/(88-38)	$24,503	=($1,313,000-$565,000)/(88-25)

control fraction = 1 - control %/100

ATTACHMENT B - COSTING

SO_2 BACT Cost Estimation Bases

The Tables 2 and 3 of this report present the emission, economic, environmental, and energy impacts for the year 2000 BACT alternatives for Simplot's Overton, NV, coal-fired sand dryer. This appendix presents the costing bases for the SO_2 control hierarchy scenarios.

For all control options, the inlet SO_2 emission rate is 57.6 lb/hr (252 tons/yr). Design waste gas parameters are: volumetric flow rate– 80,000 acfm; temperature– 225 °F; and moisture content– 21%. All costs are expressed in first quarter 2000 dollars. Primary references for the costs are: 1) Simplot internal data, 2) EPA/OAQPS CO$T-AIR spreadsheets (2nd edition), 3) EPA's *OAQPS Control Cost Manual* (5th edition), 4) control equipment vendor data, 5) *Estimating Costs of Air Pollution Control* (book), and 6) EPA's CUE (Coal Utility Environmental) COST model (version 1.0).

I. Fabric Filter with and without Dry Lime Injection

Without lime injection, a fabric filter collects SO_2 based on the amount of alkalinity contained in the material collected on the bags including ash from the combustion of coal. However, the SO_2 emission reductions due to inherent process alkalinity is variable and is not quantifiable without extensive continuous emissions monitoring data. With the injection of dry lime, the process operator has a method for controlling the reduction of SO_2 rather than just relying on the inherent process alkalinity. The amount of SO_2 removed is dependent on many factors such as flue gas approach to moisture saturation, sorbent utilization rate, sorbent-flue gas mixing effectiveness, sorbent-flue gas contact time, etc. Since most of these factors is unknown at this stage, the fabric filter is conservatively assumed to capture 45% of the inlet SO_2.[1] The PM collection efficiency of the baghouse is assigned at 99.6%, which is less than the 99.8 % removal that a baghouse without lime injection typically achieves. A lower efficiency has

[1] Depending on the lime/SO_2 stoichiometric ratio, sorbent utilization, flue gas moisture content, and other parameters, dry lime injection has a broad range of potential control efficiencies ranging from 40 to 75% removal.

been used in the former case because the injected lime increases the dust loading considerably.

The fabric filtration system includes a fully-equipped, insulated, pulse-jet baghouse, with fans, fan motor/starter, pulse jet compressor, etc.[2] However, the air/cloth ratio of the baghouse without injection is higher (about 5:1), compared to that of the unit with injection (about 3:1). In the injection case, a lower ratio–and higher bag area–was needed because of the high dust loading caused by the injected lime. With both alternatives, it was assumed that enough ductwork and a stack were already in place at the site to convey the waste gas from the cyclone to the baghouse and the stack.

It was also assumed that a pump was available to sluice the captured dust to on-site ponds. Although the pump cost was not included in the total capital investment, the cost of electricity needed to convey the sluice water was incorporated. The sluice water flow rate was calculated based on the amount of dust captured and the maximum recommended solids loading (0.30 lb solids/lb pure water)[3]. The process water cost is for water used to wet the baghouse solids calculated as 1 % of the sluice water use.

For each baghouse alternative, the energy impact is the annual power consumption of the fans and pump, combined. The solid waste and wastewater environmental impacts are, respectively, the amounts of dust captured and liquid waste streams generated by the alternatives. In reality, however, the solid waste impacts are *zero*, because, as stated above, the captured dust is sluiced to on-site ponds. By assumption, the only wastewater streams generated are those due to sluicing operation losses. The process water cost is for water used to wet the baghouse solids calculated as 1 % of the sluice water use.

The installation costs for both alternatives incorporate a retrofit penalty of 15%. The capital recovery costs have been based on a 7% annual interest rate (Office of Management and Budget-mandated) and a 20-year system life. For the lime injection alternative, a 3:1 stoichiometric ratio (Ca to S) has been used in estimating the lime requirement, as an excess of reagent is typically used with direct injection. Other inputs are listed in spreadsheets **"Fabric Filter without lime sorbent injection"** and **"Dry Lime Injection with fabric filter"**.

II. Lime Spray Dryer System

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[2] The existing baghouse on-site is a reverse-air design. However, vendor quotations solicited for this study specify pulse-jet units, due to their lower capital and annual costs.

[3] Source: *Wet Scrubbers: A Practical Handbook*, by H. Hesketh and K. Schifftner. CRC Press/Lewis Publishers, 1986.

The SO_2 control efficiency for this control scenario is 85%.[E-mail Ron Bayliss to William Vatuvuk, 01/10/2000, SDS Proposal No. 2003] In addition, a PM control efficiency (entire size range) of 99.7% has been incorporated. Primary references for the impacts were a Spray Drying Systems (SDS) Proposal No. 2003, vendor correspondence (e-mails), and the references listed above.

Sized for controlling the Overton dryer waste gas stream, the spray dryer-baghouse system consists of the following major equipment items: 1) spray dryer w/nozzles, platform, etc.; 2) two centrifugal feed pumps; 3) pulse-jet baghouse (3:1 air/cloth ratio), with bags, hopper, screw and rotary valve; 4) system fan; and 5) interconnecting ductwork. (External ductwork was not included in the quotation. However, as with the baghouse alternatives above, both this ductwork and the stack have been assumed to be in place at the site.) The quotation is based on carbon steel fabrication throughout. The installation costs incorporate a retrofit penalty of 15%. The capital recovery costs have been based on a 7% annual interest rate and a 15-year system life. Other inputs are listed in spreadsheet "**Lime Spray Dryer – Fabric Filter System**".

As with the Fabric Filter with and without Dry Lime Injection control options, it was assumed that enough ductwork and a stack were already in place at the site, and that a pump was available to sluice the captured dust to on-site ponds. However, the pump electricity cost was included in the SDS total annual cost. As above, the sluice water flow rate was calculated based on the amount of dust captured and the maximum recommended solids loading. In addition, the process water cost included in the total annual cost is for water needed to prepare the lime feed and to cover the water lost in sluicing.

Finally, because the waste gas temperature (225 °F.) is too low for efficient spray dryer operation (350-400 °F), the cost of auxiliary coal needed to heat the waste gas from 225 to 400 °F also has been included. For this alternative, the auxiliary coal adds about $221,000/year to the total annual cost (**see e-mail on calculation basis**).

III. Wet Scrubber System (with Fabric Filter)

First, it should be noted that vendors do *not* consider wet lime scrubber to be an economically viable control alternative for this emission source, as its waste gas volumetric flow rate is too low for it to be cost-effective. Lime and other wet scrubber systems are more suited for large flow rate streams with higher SO_2 concentrations, such as those emitted by utility boilers. For that reason, we did not obtain cost quotations from equipment vendors for a wet lime scrubber system. However, we were able to develop study cost estimates via EPA's CUECOST model.

The CUECOST model, which was developed for estimating coal utility boiler PM, SO_2, and NOx control costs, provides fairly current (1998) cost estimates for several wet scrubber systems, including limestone-with-forced-oxidation (LSFO). Although a LSFO system is not a lime FGD, the types of equipment used by both systems–reagent preparation, SO_2 removal, flue gas handling, and wastewater treatment–are essentially identical. The main difference, of course, is in the reagent, lime typically being much more costly than limestone. Therefore, we concluded that a LSFO would be an acceptable surrogate for a wet scrubber.

Because the CUECOST model uses utility boiler capacity (in megawatts) as its sizing parameter, rather than volumetric flow rate (in acfm), we first had to determine the size of the sand dryer in equivalent megawatts by using a acfm/MW ratio taken from CUECOST. (With utility boilers, this ratio is essentially constant over the entire size range.) Using this ratio, we computed an equivalent size of approximately 15 MW. This size fell considerably below the 100-1,000 MW capacity range in CUECOST. We input this 15-MW size into CUECOST and obtained itemized capital and annual cost outputs. These costs, however, were extremely high–several times higher than the costs of the fabric filter and lime spray drying alternatives discussed above. Clearly, downward extrapolation in this case was not appropriate.

To make use of the CUECOST model results, a lime spray dryer system (LSDS) case was run. After deducting the costs of equipment that would not be needed at the Simplot installation (e.g., ball mill for grinding limestone feed), the CUECOST-LSFO equipment cost was divided by the CUDECOST-LSDS equipment cost, obtaining a factor of 1.73. Next, the fabric filter costs were deducted from the total equipment cost from the SDS quotation. Then the adjusted SDS cost was multiplied by this ratio to obtain the Wet Lime FGD cost. Finally, the Wet Lime FGD equipment cost was multiplied by an installation factor to obtain the total capital investment. For the various operating and maintenance costs, the CUECOST outputs were used for electricity and reagent requirements. Because the CUECOST operating labor requirement was excessive–3 operators per shift–the SDS quotation estimate of 1 operator/shift was used instead. The *OAQPS Control Cost Manual* and engineering judgement were the sources of the other annual costs. Per OMB mandate, an FGD life of 20 years is used to calculate the annualized capital requirement.

As with the Fabric Filter with and without Dry Lime Injection control options, it was assumed that enough ductwork and a stack were already in place at the site, and that a pump was available to sluice the captured dust to on-site ponds. As above, the sluice water flow rate was calculated based on the amount of dust captured and the maximum recommended solids loading. In addition, the process water cost included in the total annual cost is for water needed to prepare the lime feed and to cover the water lost in sluicing. Other inputs are listed in spreadsheets **"Wet Scrubber System + Fabric Filter"**.

Appendix B -7

SO_2 BACT Cost Estimation Spreadsheets

WET SCRUBBER SYSTEM + FABRIC FILTER [1]
TOTAL ANNUAL COST SPREADSHEET PROGRAM:

COST BASE DATE: First Quarter 2000 [2]

INPUT PARAMETERS:

-- Inlet stream flowrate (acfm):	80,000	[Cost compar.]
-- Inlet stream temperature (oF):	225	[Simplot data]
-- Inlet stream pressure (in Hg):	26.50	
-- Dust type:	Coal fly ash	
-- Inlet dust loading (gr/actual ft3):	1.150	['88 stack test]
-- Inlet dust (PM) rate (lb/hr):	800.0	
-- Overall PM control efficiency (%):	99.5	['00 BACT alt.]
-- Coal sulfur content (%):	0.6	['00 BACT alt.]
-- Inlet SO2 rate (lb/hr):	57.6	['00 BACT alt.]
-- SO2 control efficiency (%):	93.0	['00 BACT alt.]
-- Max. wastewater solids content (lb/lb water):	0.30	[ECAPC]
-- Pump design pressure (psig):	20.0	[Simp.cost com]
-- G/C ratio factors (pulse-jet):	3.0	[SDS prop.]
-- Stainless steel required? ('yes'=1;'no'=0):	0	"
-- Ductwork velocity (ft/min):	4,000	[OAQPS Man.]
-- Ductwork length, straight equivalent (ft):	100	[engr. judgmnt.]
Retrofit installation adjustment factor (applied to new plant TCI):	1.15	[engr. judgmnt.]
-- Lime FGD/Spray Dryer equipment cost ratio:	1.73	[CUECOST]
-- Fraction of total SDS cost due to spray dryer, fan, pumps [3].	0.55	[SDS proposal]

DESIGN PARAMETERS

-- Gross cloth area required (ft2)--calculated via SDS A/C ratio:	26,667	[SDS proposal]
-- Total FGD power requirement (kW):	249	[CUECOST]
-- Water requirement (gal/hr):	48.7	"
-- Lime requirement (lb/hr):	71.6	[CUECOST] [4]
-- Lime feed slurry concentration (lb/lb water):	0.18	
-- Ductwork diameter (ft):	5.04	
-- Ductwork pressure drop (in. w.c.):	0.24	[OAQPS Man.]

CAPITAL COSTS

Total Equipment Cost ($)--per SDS proposal:	850,000	
Portion of total due to spray dryer, fan, & pumps:	467,500	
Estimated Lime FGD total equipment cost:	810,178	
Purchased Equipment Cost ($)--per Manual factors:	958,009	
Total Capital Investment--new installation ($):	1,825,978	[ECAPC]--[5]
Total Capital Investment--retrofit installation--lime FGD ($):	2,099,875	
Total Capital Investment--fabric filter ($):	828,753	[5a]
Total Capital Investment--entire system ($):	2,928,628	

ANNUAL COST INPUTS:

Operating factor (hr/yr):		8,760	[permit app.]
Supervisory labor multiplier:		0.15	[OAQPS Man.]
Operating labor rate ($/hr):	[6]	24.97	[DOL/BLS]
Operating labor factor (hr/sh):	[5b]	8.5	[SDS, Manual]
Maintenance labor factor (hr/sh):	[5b]	2.5	[ECAPC,Manual]
Maintenance labor rate ($/hr):		27.47	[OAQPS Man.]
Electricity price ($/kWhr):	[7]	0.0445	[DOE/EIA]
Lime price ($/ton):		150	[Simplot data]
Water price ($/thousand gal.):		0.25	[Simplot data]
Dust disposal ($/ton):		0	[engr. judgmt.]
Annual interest rate (fraction):		0.07	[OAQPS Man.]
Control system life (years):		15	[engr. judgmt.]
Capital recovery factor:		0.1098	
Bag life (years):		2	[SDS proposal]
Capital recovery factor (bags):		0.5531	
Taxes, insurance, admin. factor:		0.04	[OAQPS Man.]

ANNUAL COSTS ($/yr):

Item	Cost	Data Source
Oper. labor	232,408	SDS, DOL
Supv. labor	34,861	OAQPS Manual
Maint. labor	75,191	"
Maint. materials	75,191	"
Bag replacement [7a]	28,426	"
Electricity-lime FGD	97,065	CUECOST, DOE
Electricity-baghouse [7a]	30,652	OAQPS Manual
Elec-slc. pump	2,144	Simplot, DOE
[Slc. pump hp]	7.4	Simplot
Lime	47,050	CUECOST,Simp
Water-lime prep	107	CUECOST,Simp
Water-sluicing	523	Simplot
[sl. wtr,1000gpy]	2,090	Simplot,ECAPC
Dust disposal [8]	0	Simplot,eng jdg
Overhead	250,591	OAQPS Manual
Tax,ins.,adm	117,065	"
Cap. recov.	321,328	"
Total Annual	1,312,601	

COST-EFFECTIVENESS ABOVE BASELINE CONTROL:

C/E--PM($/ton):	[9]	502
C/E--SO2 "		5,594

ENERGY and ENVIRONMENTAL IMPACTS [10]

Solid Waste Collect. (tons/yr)	2,615
Energy (kWh/yr)	2,918,218
Wastewater 1000 gal/yr)	447.1

ANNUAL COST WEIGHTING FACTORS

Cost	Wt. Factor
Oper. labor	0.177
Supv. labor	0.027
Maint. labor	0.057
Maint. material	0.057
Bag replacement	0.022
Electricity--lime FGD	0.074
Electricity--baghouse	0.023
Elec-slc, pump	0.002
Lime	0.036
Water-lime prep	0.000
Water-sluicing	0.000
Dust dispos.	0.000
Overhead	0.191
Tax,ins.,adm	0.089
Cap. recov.	0.245
Total:	1.000

NOTES:

[1] Lime FGD system is sized and costed for Simplot (Overton, NV) sand dryer. Input (waste gas) parameters taken from Simplot data. Fabric filter is installed UPstream of FGD. Equipment cost was calculated by multiplying Spray Drying Systems cost by RATIO of lime FGD-to-spray dryer costs generated by CUECOST model. SDS cost was based on 1/10/00 quotation. ·ee spreadsheet files 'CUS-COMP.WK4' and 'S-SDS-2R.WK3'.)

[2] Date corresponding to date of Spray Drying Systems and CUECOST costs quotation.
[3] Obtained via proportioning from CUECOST inlet SO2 rate (203 lb/hr) to Simplot's.
[4] SDS provided following breakdown of their proposal: baghouse--45%, spray dryer--43%, fan--10%, feed pumps--2%. SDS noted that this itemization is approximate.
[5] "Estimating Costs of Air Pollution Control," CRC Press/Lewis Publishers, 1990. Total capital investment factored from purchased equipment cost via installation factor for venturi scrubbers (from Table 2.2, p. 20).
[5a] Calculated via separate spreadsheet for fabric filter without lime injection (TCFF00R.WK3).
[6] Labor rates for mining operations in Nevada, per Bureau of Labor Statistics, DOL (Jan. 2000).
[6a] Combined operating/maintenance labor for both lime FGD and fabric filter.
·rged by U.S. utilities to industrial customers (Jan.-Aug. '99) per DOE's Energy Information Administration ("Monthly Energy Review").
[7a] Calculated via fabric filters spreadsheet (TCFF00R.WK3).
·t can be sluiced and recycled on-site. Thus, dust disposal cost is zero.
[9] Total annual cost ($/yr) divided by total particulate captured (tons/yr). If PM10, PM2.5, or other fractions are desired, divide by ratio of PM10, PM2.5, etc., to total PM.
[10] Impacts pertain to amounts of solid and liquid waste generated, plus power consumed as a result of using this alternative. However, in this case, the solid waste (dust) captured in the baghouse ahead of the FGD is sluiced to an on-site settling pond. Thus, it is not a waste stream, per se. There are two wastewater streams: 1) the FGD bleed (equal to the water feed rate) and 2) the sluice water losses (equal to 1% of the makeup water needed to sluice the captured solids to the settling pond).

Fabric Filter without lime sorbent injection

TOTAL ANNUAL COST SPREADSHEET PROGRAM--FABRIC FILTERS [1]

COST BASE DATE: Second Quarter 1998 [2]

VAPCCI (Fourth Quarter 1999--PRELIMINARY): [3] 112.2 [CE Mag 2/00]

INPUT PARAMETERS:

-- Inlet stream flowrate (acfm):		80,000	[Simp.cost com.]
-- Inlet stream temperature (oF):		225	[Simplot data]
-- Inlet stream temperature, adjusted--pulse jet only (oF):		225	
-- Dust type:		Coal fly ash	
-- Inlet dust loading (gr/actual ft3):		1.190	['88 stack test]
-- Inlet dust (PM) rate (lb/hr):		800.0	
-- Overall PM control efficiency (%):		99.8	['00 BACT alt.]
-- Coal sulfur content (%):		0.5	['00 BACT alt.]
-- Inlet SO2 rate (lb/hr):		57.8	['00 BACT alt.]
-- SO2 control efficiency (%):		0.0	['00 BACT alt.]
-- Max. wastewater solids content (lb/lb water):		0.30	[ECAPC]
-- Pump design pressure (psig)		20.0	[Simp.cost com.]
-- Dust mass median diameter (microns):		7	[OAQPS Man.]
-- Filtration time (min):		10	"
-- Dust specific resistance (in.H2O/fpm/lb/ft2):		15	"
-- G/C ratio factors (shaker & reverse-air):	A:	2.0	"
	B:	0.9	"
	C:	1.2	"
-- G/C ratio factors (pulse-jet):	Material:	9.0	"
	Application:	0.8	"
-- G/C ratio factors (cartridge filters):	A:	2.1	"
	B:	0.8	"
	C:	0.75	"
	D:	0.9	"
	E:	1.130	"
-- Cleaning pressure, psig (pulse-jet only):		100	"
-- Fraction of bags cleaned (shaker & rev-air):		0.1	"
-- Insulation required? ('yes'=1;'no'=0):		1	[FF cost est.]
-- Stainless steel required? ('yes'=1;'no'=0):		0	"
-- Bag material:		Fiberglass	"
-- Fabric effective residual drag (in. H2O/fpm):		1.1	[OAQPS Man.]
-- Ductwork velocity (ft/min):		4000	"
-- Ductwork length, straight equivalent (ft): [4]		100	[engr. judgmnt.]
-- Retrofit factor (applied to new plant TCI):		1.15	[Simpcostcomp]

-- Bag prices ($/ft2): (from table below, for bag material selected above only) [5]

Cleaning Mech.	Bag Diam. (in.)	Price ($/ft2)	
Pulse jet--BBR	4.5 to 5.125	1.59	[OAQPS Man.]
	6 to 8	1.55	"
Pulse jet--cart.	4.875	0.00	"
	6.125	0.00	"
Shaker--strap	5	0.00	"
Shaker--loop	5	0.00	"
Reverse air w/o rings	8	0.95	"
	11.5	0.75	"

DESIGN PARAMETERS

-- Gas-to-cloth ratio (acfm/ft2 cloth area):	Shaker:	2.16
	Reverse-air:	2.16
	Pulse-jet:	5.29
	Cartridge:	1.28
-- Net cloth area required (ft2):	Shaker:	37,037
	Reverse-air:	37,037
	Pulse-jet:	15,133
	Cartridge:	62,431
-- Gross cloth area required (ft2):	Shaker:	41,667
	Reverse-air:	41,667
	Pulse-jet:	15,133
	Cartridge:	62,431
-- Area per bag--pulse jet (ft2):	Small (4.5-in. x 8-ft)	9.42
	Large (5.125-in. x 10-ft)	13.42
-- Number of bags/cages (pulse-jet only):	Small bags	1,606
	Large bags	1,128
-- Bag pressure drop (in. w.c.):	Shaker:	2.49
	Reverse-air:	2.49
	Pulse-jet:	2.32
	Cartridge:	1.46
-- Baghouse shell pressure drop (in. w.c.):		3.00 [OAQPS Man.]
-- Ductwork diameter (ft):		5.04
-- Ductwork pressure drop (in. w.c.):		0.24 [OAQPS Man.]

CAPITAL COSTS

Equipment Costs ($):

Item:	Shaker	Rev-air	P-J (mod)	P-J (com)	P-J (cartridge)
Baghouse	0	230,355	148,001	110,708	0
Bags--small	0	31,250	25,576	25,576	0
" --large			23,457	23,457	0
Insulation	0	50,048	41,316	34,789	0
Stainless	0	0	0	0	0
Cages--small [6]	0	0	9,610	9,610	0
" -large	0	0	12,448	12,448	0
Auxiliaries:					
-- Fan(s) [7]	0	43,512	43,512	43,512	0
-- Motor [8]	0	6,631	5,518	5,518	0
-- Ductwork	0	0	0	0	0
Total--small[9]	0	361,895	273,532	229,712	0
" --large			274,292	230,451	0
Low-$ PJ FF:	0	0	Small	Small	0
PEC($)-base:	0	426,800	322,768	271,060	0
" -escalated:	0	438,841	331,298	277,925	0
TCI--new ($):	0	951,851	718,916	603,096	0
TCI--retro ($):	0	1,094,629	826,753	693,561	0

ANNUAL COST INPUTS:

Operating factor (hr/yr):	8,760	[permit app.]	
Operating labor rate (S/hr):	24.97	[OAQPS Man.]	
Maintenance labor rate (S/hr):	27.47	[OAQPS Man.]	
Operating labor factor (hr/sh):	2	"	
Maintenance labor factor (hr/sh):	1	"	
Electricity price (S/kWhr):	0.0445	[DOE/EIA]	
Water price (S/1000 gal):	0.25	Simp.cost com]	
Compressed air (S/1000 scf):	0.25	[OAQPS Man.]	
Dust disposal (S/ton):	0	[engr. judgmt.]	[10]
Annual interest rate (fraction):	0.07	[OAQPS Man.]	
Control system life (years):	20	[OAQPS Man.]	
Capital recovery factor:	0.0944		
Bag life (years):	2	[OAQPS Man.]	
Capital recovery factor (bags):	0.5531		
Taxes, insurance, admin. factor:	0.04	[OAQPS Man.]	

ANNUAL COSTS (S/yr):

Item	Shaker	Reverse-air	P-J (mod)	P-J (com)	P-J (cartridge)
Oper. labor	0	54,684	54,684	54,684	
Supv. labor	0	8,203	8,203	8,203	
Maint. labor	0	30,076	30,076	30,076	
Maint. matl.	0	30,076	30,076	30,076	
Electricity--fan	0	38,587	31,428	31,428	
[fan horsepwr]	0	133	108	108	
Electricity-pump	0	2,924	2,924	2,924	
[pump hp]	0	10.1	10.1	10.1	
Water	0	713	713	713	
[water,1000gpy]	0	2,851	2,851	2,851	
Compr. air	0	0	21,024	21,024	
Bag repl.	0	28,426	20,157	20,157	
[bag price,S/ft2]	0	0.75	1.69	1.69	
Dust dispos.	0	0	0	0	
Overhead	0	73,824	73,824	73,824	
Tax,ins.,adm	0	43,785	33,070	27,742	
Cap. recov.	0	98,474	74,600	62,027	
Total Annual	0	409,773	380,778	362,878	

COST-EFFECTIVENESS ABOVE BASELINE [11]

C/E--PM(S/ton).	0	115	145	102

ENERGY and ENVIRONMENTAL IMPACTS [12]

Solid Waste Collect. (tons/yr)	0	3,567	3,567	3,567
Energy (kWh/yr)	0	932,636	771,946	771,946
Wastewater (1000 gal/yr)	0	28.5	28.5	28.5

ANNUAL COST WEIGHTING FACTORS: Fabric Filter_2002 4 of 4

Item	Shaker	Reverse-air	P-J (mod)	P-J (com)
Oper. labor	0.000	0.133	0.144	0.151
Supv. labor	0.000	0.020	0.022	0.023
Maint. labor	0.000	0.073	0.079	0.083
Maint. matl.	0.000	0.073	0.079	0.083
Electricity-fan	0.000	0.084	0.083	0.087
Electricity-pump	0.000	0.007	0.008	0.008
Water	0.000	0.002	0.002	0.002
Compr. air	0.000	0.000	0.056	0.058
Bag repl.	0.000	0.058	0.053	0.056
Dust dispos.	0.000	0.000	0.000	0.000
Overhead	0.000	0.180	0.194	0.203
Tax,ins.,adm	0.000	0.107	0.087	0.076
Cap. recov.	0.000	0.240	0.196	0.171
Total:	0.000	1.000	1.000	1.000

RELATIONSHIP BETWEEN GROSS AND NET CLOTH AREA

Net Cloth Area >/= (ft2):	Gross/Net Area Ratio:
1	2.000
4001	1.500
12001	1.250
24001	1.170
36001	1.125
48001	1.110
60001	1.100
72001	1.090
84001	1.080
96001	1.070
108001	1.060
132001	1.050
180001	1.040

NOTES:

[1] Parameters and other input data needed for this program can be found in Chapter 5 (December 1998 revision) of the 'OAQPS Control Cost Manual'(5th edition). Chapter 5 is found at: HTTP://WWW.EPA.GOV/TTN/CATC/PRODUCTS.HTML#CCCINFO.

[2] Base baghouse equipment costs (compartment, bags, insulation) reflect this data.

[3] This value of the VAPCCI (Vatavuk Air Pollution Control Cost Index) is used to escalate the baghouse equipment costs from 2nd quarter 1998 to 4th quarter 1999. Costs for fan, motor, and other auxiliary equipment items have already been escalated to 4th qtr. '99$.

) feet of ductwork (straight duct equivalent) is in place before control system is installed. Therefore, no ductwork cost is included in estimate.

[5] These prices pertain to the bag material entered above. If this bag material is not available for a baghouse type, enter '0'. (See 'Manual,' Chapter 5, Table 5.8.)

[6] Cage prices calculated from "500-cage lots" cost equations. (See Table 5.8.)

[7] Three radial-tip centrifugal fans, each sized at maximum flowrate and static pressure of 27,000 cfm and 22 inches water, respectively. Costs in 4th qtr. '99 dollars, escalated 'osts of Air Pollution Control," Lewis Pub./CRC Press, 1990.

[8] Fan motor and starter (4th Q'99 $, escalated from 2nd Q'88 $). Reference: "Estimating Costs of Air Pollution Control"

[9] Total equipment cost for "small" and "large" bags and cages cases, respectively.

[10] Disposal cost assumes dust can be sluiced and recycled on-site. Thus, dust disposal cost is zero.

[11] Total annual cost ($/yr) divided by total particulate captured (tons/yr). For PM C-E, if PM10, PM2.5, or other fractions are desired, divide by ratio of PM10, PM2.5, etc., to total PM.

[12] Impacts pertain to amounts of solid and liquid waste generated, plus power consumed as a result of using this alternative. However, in this case, the solid waste (dust) is sluiced on-site and recycled to the process. Thus, it is not a waste stream, per se. Similarly, the wastewater is exactly equal to 1% of the sluice water flowrate, to account for losses while the water is pumped from the baghouse to the settling pond on-site. The sluice water flowrate is that quantity of water needed to suspend/dissolve the captured baghouse solids for sluicing purposes.

10/08/2003 2:38 PM

LIME SPRAY DRYER - FABRIC FILTER SYSTEM [1]
TOTAL ANNUAL COST SPREADSHEET PROGRAM:

(Case 2: Adding auxiliary coal to dryer to raise offgas temperature)

COST BASE DATE: First Quarter 2000 [2]

INPUT PARAMETERS:

-- Inlet stream flowrate (acfm)--base:	80,000	[Cost compar.]
-- Inlet stream flowrate (scfm):	58,960	
-- Inlet stream molecular weight (lb/lb-mole):	28.7	
-- Inlet stream flowrate (lb/hr):	244,131	
-- Inlet stream temperature (oF):	225	[Simplot data]
-- Inlet stream pressure (in Hg):	26.50	
-- Required spray dryer inlet temperature (oF):	400	
-- Reference temperature (oF):	70	
-- Heat capacity (Cp) of inlet stream (BTU/lb-oF):	0.314	
-- Dust type:	Coal fly ash	
-- Inlet dust loading (gr/actual ft3):	1.190	['88 stack test]
-- Inlet dust (PM) rate (lb/hr):	800.0	
-- Overall PM control efficiency (%):	98.7	['00 BACT alt.]
-- Coal sulfur content (%):	0.6	['00 BACT alt.]
-- Inlet SO2 rate (lb/hr):	57.6	['00 BACT alt.]
-- SO2 control efficiency (%):	85.0	['00 BACT alt.]
-- Coal heating value (BTU/lb):	11,088	[DOE/EIA]
-- Max. wastewater solids content (lb/lb water):	0.30	[ECAPC]
-- Pump design pressure (psig):	20.0	[Simp.cost com]
-- G/C ratio factors (pulse-jet):	3.0	[SDS prop.]
-- Stainless steel required? ('yes'=1; 'no'=0):	0	
-- Ductwork velocity (ft/min):	4,000	[OAQPS Man.]
-- Ductwork length, straight equivalent (ft):	100	[engr. judgmnt.]
-- Retrofit installation adjustment factor (applied to new plant TCI):	1.15	[engr. judgmnt.]

DESIGN PARAMETERS

-- Gross cloth area required (ft2)--calculated via SDS A/C ratio:	28,667	[SDS proposal]
-- Total horsepower requirement (hp):	235	"
-- Water requirement (gal/hr):	1,076	"
-- Lime concentration (wt. %):	0.782	
-- Lime requirement (lb/hr):	70.7	"
-- Heat req'd to warm inlet stream to spray dryer temp. (BTU/hr):	13,414,980	
-- Heat req'd--coal comb. prod.--rel. to spry dry. temp (BTU/lb):	890	
-- Auxiliary coal requirement (lb/hr):	1,329	
-- Auxiliary coal requirement (BTU/hr):	14,730,435	
-- Auxiliary coal flue gas flowrate (acfm @ dryer inlet temp.):	5,993	
-- Total inlet gas flowrate to spray dryer (acfm):	85,993	
-- Ductwork diameter (ft):	5.04	
-- Ductwork pressure drop (in. w.c.):	0.24	[OAQPS Man.]

CAPITAL COSTS

Total Equipment Cost ($)--per SDS proposal:	887,650	
Purchased Equipment Cost ($)--per Manual factors:	1,047,427	
Total Capital Investment--new installation ($): [3]	2,139,846	[ECAPC]--[4]
Total Capital Investment--retrofit installation ($):	2,460,823	

ANNUAL COST INPUTS:

Operating factor (hr/yr):		8,760	[permit app.]
Supervisory labor multiplier:		0.15	[OAQPS Man.]
Operating labor rate ($/hr):	[5]	24.97	[DOL/BLS]
Operating labor factor (hr/sh):		8	[SDS proposal]
Electricity price ($/kWhr):	[6]	0.0445	[DOE/EIA]
Lime price ($/ton):		150	[Simplot data]
Coal price ($/million BTU):		1.72	[Simplot data]
Water price ($/thousand gal.):		0.25	[Simplot data]
Dust disposal ($/ton):		0	[engr. judgmt.]
Annual interest rate (fraction):		0.07	[OAQPS Man.]
Control system life (years):		15	[engr. judgmt.]
Capital recovery factor:		0.1098	
Bag life (years):		2	[SDS proposal]
Capital recovery factor (bags):		0.5531	
Taxes, insurance, admin. factor:		0.04	[OAQPS Man.]

ANNUAL COSTS ($/yr):

Item	Cost	Data Source
Oper. labor	218,737	SDS, DOL
Supv. labor	32,811	OAQPS Man.
Maintenance (incl. bag replac.)	75,000	SDS proposal
Electricity	58,339	SDS, DOE
Elec-slc. pump	2,614	Simplot, DOE
(Slc. pump hp)	9.0	Simplot
Lime	48,450	SDS, Simplot
Auxiliary coal	221,948	
Water-lime prep	2,354	SDS,Simplot
Water-sluicing	637	Simplot
(sl. wtr,1000gpy)	2,549	Simplot,ECAPC
Dust disposal [7]	0	Simplot,eng jdg
Overhead	195,929	OAQPS Man.
Tax,ins.,adm	88,433	"
Cap. recov.	270,185	"
Total Annual	1,233,435	

COST-EFFECTIVENESS ABOVE BASELINE CONTROL:

C/E--PM($/ton):	[8]	471
C/E--SO2 "		5,752

ENERGY and ENVIRONMENTAL IMPACTS [9]

Solid Waste	
Collect. (tons/yr)	3,188
Energy-electrical (kWh/yr)	1,594,448
Energy-fuel (million BTU/yr)	129,039
Wastewater	
1000 gal/yr)	25.5

ANNUAL COST WEIGHTING FACTORS

Cost	Wt. Factor
Oper. labor	0.177
Supv. labor	0.027
Maintenance	0.081
Electricity	0.055
Elec-slc. pump	0.002
Lime	0.038
Auxiliary cost	0.180
Water-lime prep	0.002
Water-sluicing	0.001
Dust dispos.	0.000
Overhead	0.159
Tax,ins.,adm	0.080
Cap. recov.	0.219
Total:	1.000

NOTES:

[1] Spray dryer-fabric filter system is sized and costed for Simplot (Overton, NV) sand dryer. Input (waste gas) parameters taken from Simplot data. Design parameters and equipment cost furnished by Spray Drying Systems, Randallstown, MD (e-mail from Ron Bayliss, 1/10/2000).
[2] Date corresponding to date of quotation.
[3] Overall installation factor obtained by multiplying standard factors for baghouses and wet scrubbers by the relative contribution each makes to total equipment cost, per SDS quotation. Contributions are: baghouse--45%, spray dryer (scrubber)--43%.
[4] "Estimating Costs of Air Pollution Control," CRC Press/Lewis Publishers, 1990.
[5] Labor rates for mining operations in Nevada, per Bureau of Labor Statistics, DOL (Jan. 2000).
charged by U.S. utilities to industrial customers (Jan.-Aug. '99) per
DOE's Energy Information Administration ("Monthly Energy Review").
dust can be sluiced and recycled on-site. Thus, dust disposal cost
is zero.
[8] Total annual cost ($/yr) divided by total particulate captured
(tons/yr). If PM10, PM2.5, or other fractions are desired, divide by ratio
of PM10, PM2.5, etc., to total PM.
[9] Impacts pertain to amounts of solid and liquid waste generated, plus power consumed as a result of using this alternative. However, in this case, the solid waste (dust) is sluiced on-site and recycled to the process. Thus, it is not a waste stream, per se. Similarly, the wastewater is exactly equal to 1% of the sluice water flowrate, to account for losses while the water is pumped from the baghouse to the settling pond on-site. The sluice water flowrate is that quantity of water needed to suspend/dissolve the captured baghouse solids for sluicing purposes.